

PATHWAYS

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No. 1

THE SKILL OF ESTIMATION

The verb 'to estimate' is explained in the dictionary as "the formation of an approximate judgement of number, amount etc.". Have you ever stopped to consider how frequently these "approximate judgements" or "estimates" are useful in our day-to-day life? When you buy cloth for your curtains you estimate the length required and add an extra length to take care of hems and the possible shrinkage of the material. Almost every day you must be estimating the time needed for different types of jobs-corrections, household chores, the time needed to walk a given distance and so on. Estimates of weight prevent our being cheated when buying provisions. Estimates of quantity (capacity or volume) are made when cooking, when filling containers and packing clothes into a suitcase. Estimates of area are made by painters when buying material to re-decorate a house or to polish furniture. A mother makes a rough estimate of the temperature of a baby's bath water. Estimates of costs are essential before you buy goods at a shop. That also leads one to consider the estimation of answers while working out mathematical problems.

All these examples demonstrate that we constantly use the skill of estimation. Yet, how infrequently are students trained to make estimates and develop this skill! Remember an estimate is not a wild guess, but a reasoned one, based upon certain pre-knowledge. This pre-knowledge usually consists of a clear mental picture of the physical size of the unit in which the estimate is to be made. Thus to estimate a linear measurement, we need a mental picture of the size of 1 cm. or perhaps 1 m. Similarly to estimate time, we need to know how long 1 second or 1 minute is.

Given below are some exercises which help in developing the skill of estimation. Try them yourself before experimenting with your students. Like any skill, repeated practice helps in improving one's ability. You might find many opportunities where students can be asked to make an estimate before finding out an exact answer or measurement.



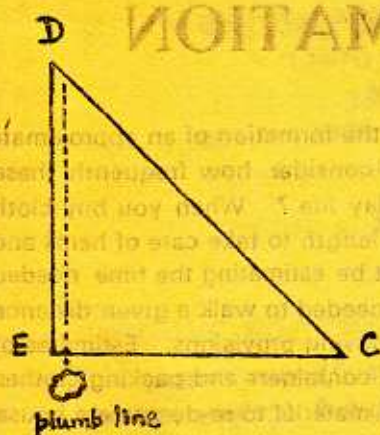
The Estimation of Length and Width

1. The small line drawn on the left is exactly 1 cm long. Look at it carefully and then estimate the length of the other lines. Measure them to check your answers. Use a string to measure the curved line.

2. The line on the left is 1 mm thick. Estimate the width of the other figures and check your answers by measurement.

The Estimation of Height

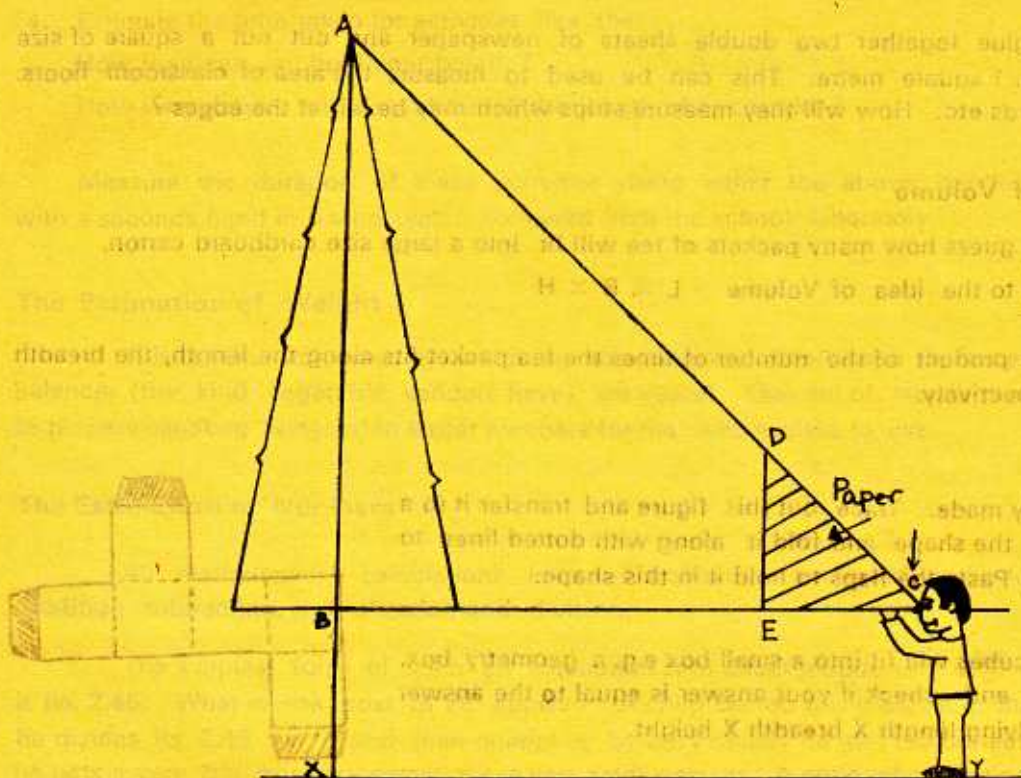
3. This is done by comparing the height of a known object (say a man) with the height of the given object (say a tree or a building.) How many times will the first measure fit into the second?



4. Another method useful to estimate the height of trees etc is the use of a clinometer. It is easily made from a square of thick cardboard or stiff paper folded across the diagonal to form a right-angled triangle. A plumb line added as shown ensures that the base is horizontal with respect to the ground. If the clinometer is not correctly held the plumbline, which always shows the vertical direction, will not be parallel to the edge DE.

The student holds the clinometer at eye-level as shown and walks backwards from the tree till its highest point is in line with CD. He measures his distance from the tree XY and his own height CY.

$$\begin{aligned}\text{The height of the tree} &= AB + BX = BC + BX \\ &= XY + CY \\ &= \text{Distance from tree} + \text{student's height.}\end{aligned}$$



The Estimation of Area

These exercises also help in clarifying the concept that area refers to the flat surface of any object and that to measure area the surface needs a closed boundary.

5. On a stencil draw a grid each of whose squares is exactly 1 sq cm in size. Duplicate as many copies as needed. Students may be asked to colour or shade in rectilinear figures of different shapes whose area is specified by the teacher.



6. Once the mental picture of a square centimetre is established in the students' minds, they can estimate the area of flat rectangular objects or other objects bounded by straight lines.

The estimates may be verified by placing the object on the paper, drawing its outline and counting the number of squares falling within it.

7. The area of irregular shapes may be estimated as $\times + \frac{1}{2} Y$, where $\times$ = the number of complete squares within the boundary and Y = the number of squares of which half or more than half fall inside the boundary.

8. Children can glue together two double sheets of newspaper and cut out a square of size $1\text{ m} \times 1\text{ m}$, that is, 1 square metre. This can be used to measure the area of classroom floors, verandahs, courtyards etc. How will they measure strips which may be left at the edges?

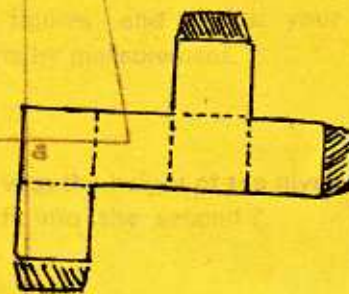
The Estimation of Volume

9. Ask children to guess how many packets of tea will fit into a large size cardboard carton.

This leads to the idea of Volume = $L \times B \times H$

It is given by the product of the number of times the tea packet fits along the length, the breadth and the height respectively.

10. A cm^3 is easily made. Trace out this figure and transfer it to a thin card. Cut out the shape and fold it along with dotted lines to form a small cube. Paste the flaps to hold it in this shape.



How many such cubes will fit into a small box e.g. a geometry box. Estimate, measure and check if your answer is equal to the answer obtained by multiplying length $\times$ breadth $\times$ height.

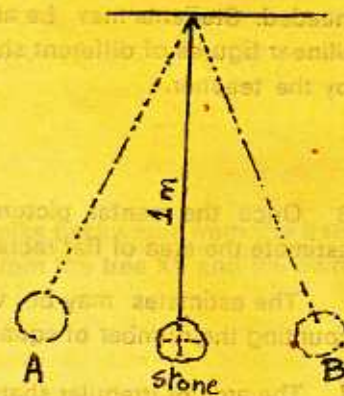
11. A milk bottle provides a handy measure equal to 500 millilitres. Once this unit is known estimates of the volume (capacity) of different containers are possible. A milk bottle usually contains two glasses. This provides us another useful approximate measure :

1 glass = 250 ml.

The Estimation of Time

12. To give yourself an idea of how long one second is, try saying *Brahmaputra* or *Tungabhadra*. Each word takes approximately one second. Another way is to count, "Mississippi One, Mississippi three..." at a normal speed. Each phrase takes one second.

13. Improvise a pendulum using a string and a stone. Fix the length of string equal to 1 metre as shown. Each complete oscillation of the pendulum takes 2 seconds. It moves from A to B in one second (i.e. half an oscillation)



14. Estimate the time taken for activities like these :

How long can you hold your breath ?

How long do you take to walk (run) the length of a corridor ?

Measure the duration of these activities using either the above pendulum, a wrist watch with a seconds hand or a stop watch borrowed from the school laboratory.

The Estimation of Weight

This is best achieved by weighing experiences. Improvised balances or common beam balances (the kind vegetable vendors have) are useful. One set of standard weights can be used to prepare sandbag 'weights' in larger numbers for the whole class to use.

The Estimation of Numbers

All mathematical calculations in real-life situations are based on the four basic operations - addition, subtraction, multiplication and division.

The simplest form of such an estimation is in direct proportion. E.g. the cost of 7 apples is Rs. 2.45. What is the cost of 28 apples ? A child can do this problem in many ways. Usually he divides Rs. 2.45 by 7 and then multiplies by 28. Possibly he gets the correct answer; sometimes he gets a very big answer; sometimes a very small answer. A child who is trained in estimation will think the following way : i. The cost of 28 apples is more than the cost of 7 apples. ii. He will find the relationship between 7 and 28 and say the cost of 28 apples is four times the cost of 7 apples. iii He will say to himself the cost of 7 apples is about Rs. 2.50 nearly (near 2.45) and hence 4 times 2.50 is Rs. 10/- and concludes that the cost of 28 apples is a little less than ten rupees. He may even compute the final answer as Rs. 9.80 in his mind by calculating that it is 4×5 p less than Rs. 10/. When he works out the problem dividing by 7 and multiplying by 28, if he does not get the answer as nearly Rs. 10, he will realise that there is something wrong in his working, this will lead him to rework the sum until he gets the correct answer.

Another example : 48 labourers can finish digging a canal in 30 days. If there are only 20 people to work, how long will it take to complete the work ? The first thing that the child should estimate is that the answer will be more than 30 days. As the number of men decreases, the days needed to complete the work increase. 48 people take 30 days. He mentally works out that if there are 24 people (half of the original) the time taken will be 60 days (double) and if there are 16 people ($\frac{1}{3}$ of the original) the time taken will be 90 days (3 times). Since he has 20 people the answer must be between 60 and 90 days. He may even conclude that the answer is somewhere midway between 60 and 90 days. This kind of thinking is useful before working out the problem.

This kind of mental estimation can be observed and taught to a child from childhood. After putting out two set of sweets (or stones) ask the child which is more. The child does not know how to count but he does perform some sort of estimation in order to give you an answer. I would like to recommend exercises to train a child in estimation once he knows how to count up to a hundred, at least. The first stage will enable him to round off two digit numbers up to the nearest ten. A sample exercise is as follows :

15. Round off these numbers to the nearest ten,

4 — 0	28	48	73
9 — 10	34	51	75
12 — 10	36	58	78
16	45	62	85
23	47	67	67

All the numbers which are 4 or less than 4 in the units place of the two-digit number are taken as zero. 73 is nearer to 70 than to 80. Similarly the numbers which are 5 or more than 5 in the units place of the two-digit number are considered as a 'ten'. Thus 85 becomes 90 and 58 becomes 60. In other words these are approximations to the nearest ten.

Notice that in planning exercises of this kind, the teacher will have to think a little and make sure that all the different possibilities are included. In the above case there could be two-digit numbers ending in 4 or less than 4, ending in 5 or more than 5 and ending in a zero.

16. The next stage is the addition of a two digit number to another two digit number so that the answer is below 99. A sample of the exercise could be as follows:

add	estimate	correct answer
37 + 42	40 + 40 = 80	79
17 + 21		
31 + 48		
36 + 37		
49 + 23		
28 + 29		
23 + 37		
44 + 45		
49 + 27		
71 + 13		
63 + 31		

37 is nearly equal to 40. 42 is also nearly equal to 40. Therefore the addition result will be nearly equal to 80. A child who masters this technique may immediately state that the correct answer is 79.

17. A sample card for the subtraction of a two digit number from another two digit number.

Subtract	Estimate	Correct answer
72 — 23	70 — 20 = 50	49
66 — 27		
36 — 17		
88 — 63		
68 — 27		
94 — 37		
67 — 39		
46 — 23		
34 — 16		
78 — 39		
39 — 5		

72 is nearly 70 and 23 is nearly 20. Hence the answer is approximately $70 - 20 = 50$. The correct answer is 49. This mental process helps the child to narrow down the range of answers getting close to the correct answer.

The chances of getting wildly incorrect answers are less. He also learns to look at numbers in their totality, realising the true value of the digits. Subtraction will no longer imply merely one digit taken away from another regardless of their place value.

We can use the skill of estimation to some extent in multiplication and division also. This practice will help the child to estimate the approximate answers of multiplication and division especially when using larger numbers.

18. Let us start with the multiplication of a two-digit number by a one digit number. A sample exercise on multiplication is given here.

Multiply	Estimated answer	Correct answer
39 × 8	$40 \times 8 = 320$	312
72 × 4		
45 × 6		
62 × 7		
53 × 8		
64 × 4		
49 × 5		
33 × 3		
92 × 4		
72 × 3		
82 × 9		

A child who has a lot experience in this pattern will be in a position to give the correct answer by mental computation. For e.g. 39×8 is considered by the child as $40 \times 8 = 320$. The child, if he is aware that he has taken eight times one ($40 - 39 = 1$) more than needed will subtract 8 from 320 and give the correct answer as 312, worked out mentally without actual computation on paper.

One more example : 82×9 may be thought of as $80 \times 9 = 720$. This is an approximate answer to the problem. If the child is aware that he has left out the units digit in his approximation ($82 - 80 = 2$) he will immediately add $9 \times 2 = 18$ to the approximate answer and give the correct answer as 738.

19. A Sample Work Card for Division

Training in estimation in the division process is very important as estimation is an integral part of long division. Division is one of the major bottlenecks for children learning mathematics in primary classes. Estimation in division will help to understand the concept of division and to make the process of division more meaningful. Let us start with division of two digits by one digit.

There are two ways of looking at division: (1) approximating the dividend (2) considering the tenth multiple of the divisor. A sample work card for division (approximating the dividend) is given here.

	Divide	Estimated answer	Correct answer	Remainder
a	$91 \div 9$	$90 \div 9 = 10$	10	1
b	$67 \div 7$	$70 \div 7 = 10$	9	4
c	$63 \div 6$			
d	$42 \div 4$			
e	$48 \div 4$	8	8	2
f	$50 \div 6$	22	22	1
g	$7 \div 3$			
h	$49 \div 8$			
i	$83 \div 8$			
j	$89 \div 7$			
k	$73 \div 8$			
l	$69 \div 5$			

In exercise a : The dividend 91 is approximately equal to 90. Division by 9 gives an estimated answer of about 10.

The children may find it difficult to get the approximate answer some times. Still drilling like this is good for practice of multiplication tables.

The same problems can be done another way. Consider exercise f : $50 \div 6$. The tenth multiple of the divisor 6, is 60. 50 is less than 60. Hence the quotient is less than 10. There is a shortage of 10 in the dividend. This shortage can be thought of as $6 + 4$. Therefore the shortage is almost equal to two sixes. Hence the estimated answer is 8.

Take example g : $67 \div 3$. 30 is 3×10 . There are two 30's in 67. Hence the answer will be more than 20. In the remaining 7 ($67 - 60 = 7$), three goes twice. Hence the estimated answer is 22.

Look at a few more examples : $69 \div 5 = (50 \div 5) + (19 \div 5) = 10 + 3$ and remainder 4.

Consider $73 \div 8$. Here a difficulty arises. 8 times ten is 80. There is a shortage of 7. Hence 8 does not divide 73 ten times. The answer will be less than 10. Here the child has to try out nine or eight times eight to arrive at the correct answer. He cannot put it down as $73 \div 8 = (80 \div 8) - (7 \div 8)$. Such an equation, though algebraically correct, would make the process of estimation more complex than straightforward division !

Finally look at $49 \div 8$. Here 8 time 10 is 80. The child has to realise that 40 is half of 80. Hence 8 goes into 49 at least five times. The remaining 9 and further be divided by 8 i.e. $49 \div 8 = (40 \div 8) + (9 \div 8) = 5 + 1$ and remainder 1.

So far we dealt with two-digit numbers. Before proceeding to numbers with three or more digits the child has to be trained to round off numbers to the nearest ten, to the nearest hundred or the nearest thousand. Here are some samples.

20. Round off these numbers to the nearest ten.

937	397	793	484	844	448	721	127	217
271	791	197	917	971	534	435	453	345
354	543	672	762					

21. Round off these numbers the nearest hundred

6	27	50	150	261	372	392	441	563
729	743	783	841	821	873	391	901	991
666	736							

The above exercises will help the child in mental estimations of all operations involving large numbers having three or more digits.

A few examples of multiplication and division are shown below.

69×27 is nearly equal to $70 \times 30 = 2100$

82×48 is nearly equal to $80 \times 50 = 4000$

$475 \div 29$: 29 is nearly equal to 30. How many 30's are there in 475 ? 300 has ten 30's and 175 has five 30's. Hence the answer must be around 15.

A practical problem : When can you give these exercises to your students ? One school solved this by preparing a large number of workcards and storing them in the classroom. As class-work gets finished and students have a few moments to spare before the bell rings, they are given these cards. Answers are written out in notebooks so that the cards remain undamaged and can be re-used

Gayatri Moorthy & Jose Paul

* * *

An Experiment to Bridge Cultural Gaps

During the visit of a delegation of American teachers to Delhi, Mrs. Wanda Prince of the Paragould High School, Paragould, Arkansas, visited Sardar Patel Vidyalaya. Together we decided to bring out a joint brochure based on articles contributed by the students of the two schools. They were to cooperate in this cross-cultural project, exchanging essays and letters on subjects of interest to the youth of both the countries. The project was financed by the U.S. Department of Education in Washington D.C. and resulted in the publication of a fifty page brochure.

The emphasis in the study of history has now definitely shifted from political history to social, economic and cultural history. One of the useful ways to study the cultural history of a country is, perhaps, to establish direct links with the people of that country. The World History class of the Paragould High School had to study about India. They, we hope, were able to understand India in a better way through this project.

The project was worked on at two levels. On the one hand, individual children wrote to each other, exchanging details of their personal lives and interests. On the other hand,

groups of students worked on topics which they thought would interest their counterparts. The American students wrote on education, sports, leisure time activities, clothing, family life, religion, music and youth problems. They supplemented their write-ups with a lot of visual material. Clippings from their local newspapers about their sports activities made their articles more meaningful. On clothing and weddings, they had sent colourful pictures that illustrated their articles most effectively. They had carried out a survey amongst the youth on 'Music' and 'Youth Problems'. The youngsters of Paragould face problems that included alcohol, drugs, student acceptance and peer group pressure. Yet they are basically a well-adjusted group.

From India, we sent them write-ups on Family Life with a special feature titled 'Grandfather's Eightieth Birthday' the *Sadabhishekam*, being a particularly important celebration, amongst South Indians. Other articles included one on Food (with some recipes), Clothing, Festivals, Weddings and Religion. Photographs of joint and nuclear families; visual materials on the variety of foods, how they are served and eaten; traditional and modern dresses and accessories such as jewellery and footwear were collec-

ted. One interesting piece was: 'How to make Kohl at Home'.

We also sent them an account of the 'Activity Week' in our school, accompanied by many photographs showing the wide variety of extra-curricular and cultural activities which go on during the year at Sardar Patel Vidyalaya. We felt they would be interested in learning about our city, Delhi, and took care to emphasise both the ancient and modern aspects of this historical city.

I organized a programme in school during our Cultural Activities period during which our students viewed a slide-tape show produced by the students of Paragould High School. My students found it rather surprising that their American friends thought it necessary to explain terms like 'garage' and to describe how basketball is played. Obviously an information gap exists—so that they do not realise just how 'advanced' we are!

Suchitra Srinivasan who spoke during the programme pointed out that she learnt more about India while working on the project and found that she appreciated our cultural heritage better than ever before. Nilanjan Gupta said that

he was proud to be an Indian. He thought, perhaps, American children really do not have much to do during their spare time. He commented: "The more problems we have, the more challenging and exciting life is."

Sharad Chauhan realised, after receiving some letters, that teenagers everywhere are the same. Quoting from one of the letters he said that his American friend was "feeling miserable about leaving school after graduation".

We displayed all the material received on bulletin boards in the school. Many students of other classes were seen poring over them.

It is obvious to anyone who reads the booklet that this group of American children is not yet familiar with our customs and many concepts are still not clear to them. It also highlights the fact that ours is a rich culture which can best be understood by direct exposure—perhaps by living in India for some time.

However, it was a unique experiment—a small step towards building a cultural bridge with young people living thousands of miles away.

Chitra Subramaniam
Sardar Patel Vidyalaya

BASIC FACTS ABOUT TEETH

—A Science Project

Many teachers in middle school classes either read the lesson aloud and explain it in class, or explain the lesson without reading it, leaving out some facts from the text to be tackled by the students themselves.

When I was teaching the chapter on 'Food and Energy' to class VII students, this is how I went about it and the encouraging result I got, prompted me to share it with readers of Pathways.

To introduce the topic, I read to them a poem: "I Wish I Had Looked After Me Teeth" by Pam Ayre, after which I discussed with the students the following points:

- advantages and disadvantages of brushing teeth
- other ways of cleaning teeth like using charcoal, salt, ash—their merits and demerits.

The students were then asked to prepare a project on a "Balanced Diet". They took up the project very enthusiastically and with it, they also prepared a project file on "Basic Facts about Teeth". For these two purposes, they consulted dieticians, dentists and also referred to books from the school library.

The sub-headings under which the students worked were :—

- * What is a balanced diet ?
- * What is an Indian's diet ?
- * What is a European's diet ?
- * What is my diet ?
- * How to balance my diet (including advice for mother) ?
- * Deficiency diseases.
- * The anatomy of a tooth
- * What is a healthy tooth ?
- * How does tooth decay start ?
- * The prevention of gum and tooth decay.
- * The correct methods of brushing teeth.

- * When should you consult your dentist ?
- * Is professional cleaning of the teeth necessary ?
- * The types of teeth
- * Is thumb sucking harmful ?
- * The relationship between nutrition and dental health.

The result was that the next chapter, 'What Happens to Food ?' was partially covered and I did not have to explain it in class. I utilized the time saved thus for the below average students of the class. The projects submitted had various colourful pictures, collages (using pictures of toothpaste advertisements) diet tables etc. This attempt made me feel that the students are capable of doing things on their own. Why not provide opportunities for them where they can bring out their hidden talents ?

Mrs. M. Gujral
Bluebells school
Kailash Colony, New Delhi.

Pupil Participation

In as much as first hand experiences are fundamental to learning science, it follows that each pupil needs to have a rich variety of such experiences. Everyone, therefore, should participate in science activities, and no one need be a mere onlooker.

For example, when studying magnetism, all the children can work with their own "Bobby-pin Compasses" rather than just watch the teacher demonstrate. Everyone can have his own animals and plants for close scrutiny. The entire class can contribute to the rounding of "Brick Pebbles".

Demonstrations should be used sparingly—chiefly to show pupils what to do or how to do it, and to perform those few things which are too difficult, dangerous, or expensive for everyone to try.

Having every pupil participate may, at times, raise problems—problems of time, materials, sto-

rage and behaviour. But these have solutions that are often obvious if the basic purposes of the teaching are kept clearly in mind. For example :

1. Attempt to "cover" less, but teach it better by giving pupils ample time and opportunity for firsthand experiences.
2. Make much use of everyday things such as cans, pebbles, nails, and vinegar—all available in quantity at little cost.
3. Use the playground lawn, gymnasium, and corridor for science activities, as well as window sills and chalk trays.
4. Let pupils help store supplies in boxes, cans and jars, and teach them to get the items as needed and to put them back.
5. Keep pupils busy with worthwhile activities, and there will be little mischief—even though, perhaps, a bit more noise.

From Teaching Science with Everyday Things by Victor E. Schmidt and Verne N Rockcastle.

A Problem Solving Situation

DUNNIT

The children of a small town called 'DUNNIT' woke up one morning to find that all their parents were missing. They found that the school was closed. There was nobody in the shops and the water and electricity had been turned off. All the grown ups had gone and only the children remained. They swarmed through the streets to the Community Hall where they found a letter pinned to one of the doors.

"Our parents have left us a note" shouted one of them loudly. "Read it," shouted the children. The note read thus:—

"To our ill-bred children. We have had enough. Our patience is at an end. Your behaviour in the past has exceeded all bounds. We give up hopes of ever educating you. Our final decision is that we will have nothing to do with you any more. We are, therefore, leaving the town forever. Even if you look for us you will not find us. For once you should understand that parents are there for another reason than to be angry with you. Good Bye!"

The Parents of 'DUNNIT'

This passage when given to the children can spark off several reactions-internal as well as external. The scope for creative thinking and writing, exploiting such a text is immense.

Starting from why they think the title 'DUNNIT' is appropriate, to creating problem-solving situations, the exercise can be exciting and thought provoking. The creative child would present unusual solutions to problems; the naughty child would perhaps make amends through his imagination, the mature child may put forth his good values to the group and the lively child may excel in role plays. Whatever it may be, the dynamic teacher has before her, an opportunity to exploit to the maximum of her capacity.

I will be happy to have a feedback from any teacher who tries this out in her class.

(Mrs.) S. Sunderarajan
Teachers Centre,
Springdales School.

Your Attention Please

PATHWAYS is issued four times a year—in February, April, August and November. The annual subscription is Rs. 8/- only. Please send this in as a Money Order or Cheque (add outstation charges please) to the Educational Planning Group, 4 Raj Niwas Marg, Delhi-110054. This entitles you to all the four issues of that calendar year. Remember to include your complete and correct postal address, including PIN Code. Back numbers can be obtained for Rs. 2.50 each (including postage).

Painting Can Be Fun

Art and Craft classes occupy an important position in the pre-primary and primary classes. Yet how often do "drawing classes" give children an opportunity to develop their own creative talents? Frequently our young learners do little more than copy a "picture" which the teacher has drawn on the blackboard. Using brushes and paint, rather than tiny crayons which are difficult for small fingers to hold, helps develop muscular control. Here are some tips for the teacher who is bold enough to experiment with her class.

Aim for a good working atmosphere where children can enjoy painting and continue to learn. Know what to suggest (techniques) and when not to interfere (choice of colours, subject matter). Don't ask a young child what he/she has painted. Encourage the student instead, with, "That looks interesting. Tell me about it".

Crowded classrooms and tables usually mean small sizes of paper and shorter periods of concentration. The quality of a child's work is often directly related to the amount of space available. Sloping easels are useful to display finished work but are not easy to work on. If table space is limited, spread newspaper on the floor and make sure that there is adequate elbow room between the students.

Provide paper as large as possible - the reverse of old charts, newsprint or newspaper are some possibilities. These need not always be oblong in shape. Selecting a suitable paper from a variety of shapes, colours and textures adds interest to the exercise. Sometimes, especially for painting patterns, it is stimulating to restrict the choice of colours.

Young children do not need a wide range of colours. Red, clear yellow, blue, black and white are adequate. They can easily be mixed to obtain other shades like orange, green, brown and grey. Powder colours, ready-mixed, may be kept in wide-mouthed jars or bottles, in a tray which takes care of all spills. This material may perhaps be shared by two students.

Teach children simple but important rules like always returning a brush to its own colour, wiping off excess paint on the rim of a pot of paint, rinsing brushes and squeezing out the water before re-use, avoiding dilution of a prepared paint and washing and storing of brushes upside down when work is complete.

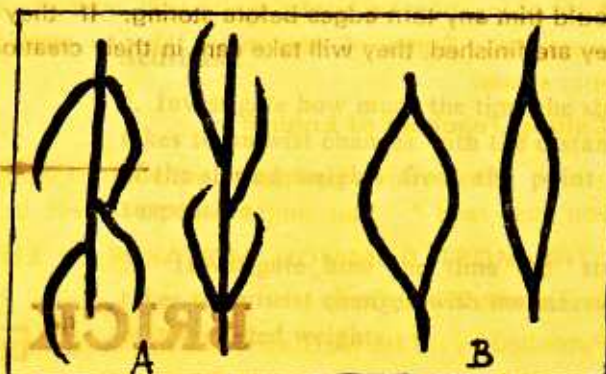
Provide as good a selection of brushes as possible. At least three sizes - a fat bristle, a thin bristle and one fine brush (for detail) - may be put into each pot of paint. Some long handled brushes must be available to help young children acquire confidence in painting large areas with a sweeping, firm hand,

Show children how to paint by practising brush strokes. A short spell of this before they work on individual paintings is usually enjoyable. This practice could use up small papers of varying sizes and often stimulates children to do larger works.

Encourage long, continuous sweeping lines—both straight and wavy ones. Practise a wide variety of line and shape to develop a smooth, free movement of the arm. A long strip of paper is a good idea for a fence pattern.



Practise blobs and circles, fish and balloon patterns. The wrist curves the brush gently while holding it upright. When the child has good control of the different sizes of brush using these straight and wavy lines, he can practise joining one line to another, where the second brush stroke needs to merge somehow into the first. Use leaves as examples to practise. The technique is not easy. Notice how the brush strokes taper off towards their ends. Also observe that the brush is generally drawn in the same direction on the branched portions of A.



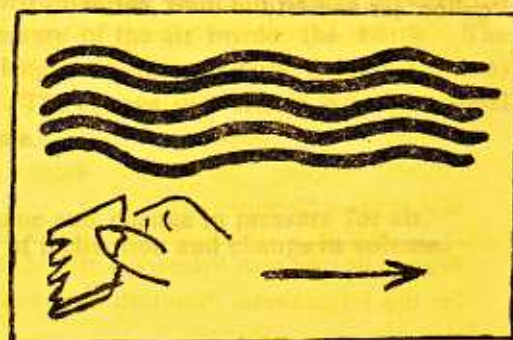
Show older children how to do a wash, using gentle strokes with large brushes. Wet the paper on both sides under a tap. Place it on sheets of newspaper and smooth the corners gently to make a flat surface. While the paper is still wet brush in the colour in light, even strokes all in the same direction. The paint must not be too thick. If the wetting, flattening and wash are too difficult for young children pin the paper to a board by each corner and wet with a sponge. Use a large brush for the colour wash.

The wash can be used over crayon drawing, or to make pictures with a wash of different colours. Care must be taken when the colours merge. Use as few strokes as possible.

Interesting patterns result when paint or dry powder is spattered onto a wet ground. The colours merge and spread and the attractive pattern when dry can be used to make book backs, or water, autumn leaves and hillsides etc., on friezes.

Practise putting one colour onto another wet colour (wiping the brush before returning it to its pot) and putting one colour onto a dry colour. Encourage patterning of large areas as in a 'scribble picture'. A dark crayon traces a pattern over a large paper and the areas are painted in. The areas may be overpainted in patterns and colours.

Attractive patterns can be produced by using a tool, usually a piece of card cut into a comb, to spread thick paint and expose the paper beneath. The paint is mixed to a thick consistency with cold water. Paint the paper. Trail the cut edge of the comb through the paper. Fingers, crayons etc. can be used instead of the cardboard.



Easy repeat patterns can be prepared for painting by using charcoal. The design is drawn in charcoal on the paper. This is folded over and the back rubbed firmly. The design transfers to the lower part. Fold again for further transfers. When the design is painted in thick colours the charcoal is covered.

Themes for illustration should be specific rather than general. Too wide a choice can be confusing. For instance, suggest 'Eating our Icecreams' rather than 'What I Did on a Holiday.' Look for poems-short ones-which tell a story and can easily be illustrated.

Mount children's painting where possible, on dark toned paper, leaving a little more room at the bottom than elsewhere. Use children's painting (and any other works, for that matter) wherever possible, and if it isn't possible to display at once, store the painting in individual folders. Sheets of newspaper stapled make an adequate folder, which will last a term. The children should trim any torn edges before storing. If they see that care is taken of their paintings after they are finished, they will take care in their creation.



BRICK PEBBLES

—An Experiment on Erosion—

A class can easily learn at first hand how the abrasion of rocks may occur. Break a common red brick with a hammer. Put about 8 to 10 jagged pieces each about 2-5 cm across into a strong thick-walled jar with a lid. Add water till the jar is about half full. Close it tightly and place it in a strong paper or polythene bag, in case it breaks during the experiment.

Ask 10 students to give the jar 100 shakes each-not so hard as to break the glass. Then let the class examine the fragments, observe the colour of the water and scrape the inside of the jar with their nails. Pour the water into a large 'gallon' jar and let the mud settle.

Repeat this experiment, giving the fragments 1000 shakes daily till they are well rounded. Record the number of shakes, note changes in the fragments and the jar and save the mud.

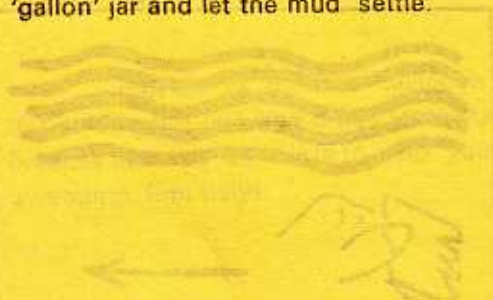
Discuss: Does the water abrade the fragments or do they wear each other and the jar?

Where does this sort of thing happen to real rocks?

Might mud be formed from these rocks.

Can rocks like sandstone or limestone also be abraded this way?

Does sand speed up the process? How will you find out?



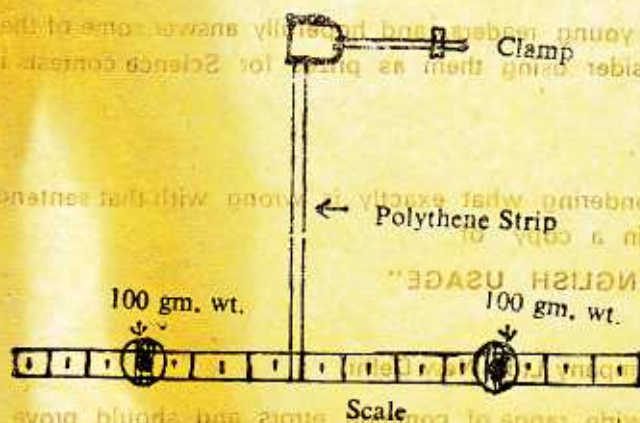
* * *

Two Science Projects for Seniors

—Lalit Kishore, Principal
Central School, Tenga Vally
Arunachal Pradesh-790115

The Effect of Moment of Inertia on Rotation

Take a half metre scale and suspend it using a polythene strip (25 cm x 2 cm) tied to its centre. Attach two slotted weights of 100 gm each to the either side of the scale using rubber bands. Balance the scale initially. Note down the distance of the slotted weights from the centre of suspension. Give five twists to the polythene strip and allow it untwist on its own. Use a stop clock to note down the time taken by it to untwist.



Activities :

1. Investigate how much the time the strip takes to untwist changes with the distance of the slotted weights from the point of suspension.
2. Investigate how the time the strip takes to untwist changes with the measure of the slotted weights.

Fig. Set-up for studying the effect of Moment of Inertia on rotation.

Improved Boyle's Law Apparatus

Take a 750 ml bottle and fix in its mouth a cork with a 75 cm long capillary tube. Put a 25 cm long mercury index into the capillary tube. The arrangement should be absolutely air-tight. This can be achieved by sealing the cork with wax. Attach a scale behind the capillary tube. Keep the bottle horizontal, now the vertical distance between the ends of the index is zero and hence the pressure difference between the air inside the bottle and outside it is zero.

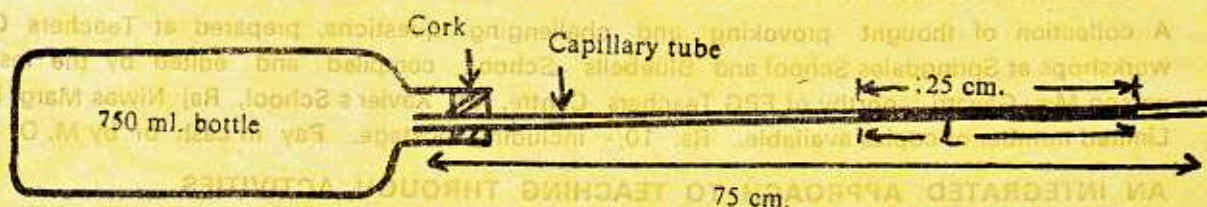


Figure : Improved Boyle's Law Apparatus

As the bottle is raised at various angles to the horizontal, the vertical distance between the ends of the index increases which causes a change in the pressure of the air inside the bottle. The change in pressure is given by $l \sin \theta$, where l is the length of the mercury column (25 cm) and θ is the angle between the bottle and the horizontal. The change in volume is proportional to the change in the length of the air column read on the scale.

Activities

1. Investigate the relationship between change in volume and change in pressure for air.
2. Also investigate the relationship between the angle of inclination and change in volume.

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